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Black-White Differences in Schooling Investment and Human Capital Production in Segregated Schools

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The lower level of school quality available for blacks relative to whites in the segregated era is frequently cited as a primary cause for the currently observed gap in black-white average wages. The inferior education provided to black children is argued to have caused lower levels of human capital production in black schools than white schools. The gap in black-white wages can be traced to this gap in human capital. Similarly, the convergence in black-and-white average wages during the 1960's and 1970's may be explained by the steady convergence in black-and-white school quality and attendance that began in the 1940's.[1]

Given the presumed importance of school quality differences in explaining both the existence of and the changes in black-white wage differentials, little is known about the human capital production process in the segregated schools. While studies of educational production processes exist, virtually all cover periods following the 1954 Supreme Court ruling against "separate-but-equal" schools. We therefore have no direct evidence regarding the extent to which differences in black-white school characteristics may explain the differences in human capital investment and production between black-and-white children in the segregated era.[2]

The objective of this paper is to present an econometric analysis of the determinants of achievement (measured by test scores) and attendance in black-and-white segregated schools, utilizing data from Maryland grade schools from 1924 through 1938. The results show that black-white differences in school characteristics explain virtually all of the differences in school attendance between black-and-white children in the period. Second, the determinants of achievement in black-and-white schools were not statistically different. This implies that, had school quality been equalized between blacks and whites, their school achievement would have been more equal, and the remaining differences in student achievement would have been due to other factors such as differences in socioeconomic backgrounds. Differences

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[1] Finis Welch (1973) and James Smith and Welch (1977) are prominent proponents of this "vintage" explanation for the convergence in black-white average wages over the past two decades. This view has been challenged on two fronts. Richard Freeman (1973) argues that increasing relative demand for black workers due to governmental action to reduce discrimination has caused the gap in black-white wages to narrow. Edward Lazear (1976) contends that the narrowing gap is merely an exchange of higher entry-level wages for blacks for lower wage growth later in life.

[2] If the production process were stable, we could use the results from more recent studies to make inferences about school achievement in the segregated era. Unfortunately, there is little agreement as to which characteristics are important in the human capital production process. Even if recent studies agreed on some set of school characteristics, these studies may give a misleading picture of human capital production in earlier periods due to the convergence in school quality measures across school districts over time. As an example, the characteristics Welch (1973) uses to illustrate the convergence of school quality across racial groups, namely school attendance, teacher salaries, length of school term, and expenditures per pupil, generally have small measured effects in studies of the determinants of average child achievement across school districts. It would be wrong to conclude from such studies that these characteristics do not affect student achievement. The small or statistically insignificant parameters for these characteristics do not imply that they are unimportant in determining the *level* of achievement; only that they are unimportant in explaining the *differences* in achievement across school districts.

in school quality accounted for an average of 37 percent of the observed differences in student achievement in the sample period. Finally, the school characteristics that proved to be important in explaining attendance and achievement in this sample exhibited tendencies to converge across races later in the century, signaling a convergence in human capital production between blacks and whites. These findings provide strong support for the role of school quality in helping to explain the differences in human capital investment and production and the resulting differences in returns to schooling between blacks and whites.

The discussion will proceed as follows: Section I presents a modeling strategy for analyzing school attendance and human capital production. Section II discusses the data. The estimation is reported in Section III.

I. Theory

We assume that parents make the decisions regarding the proportion of time their child will spend in school. This decision is based on a utility maximization framework in which parents derive satisfaction from their child's achievement in school. Parents are assumed to know the learning process by which school characteristics and child time spent in school are translated into human capital. By imbedding this educational production process into the parents' maximization problem, we can derive a demand function for schooling which shows that a child's attendance is determined by school characteristics, the child's wage, the parents' wage, and family assets. This attendance equation has the general form

$$(1) \qquad A = f(w^p, w^c, Y, S),$$

where A is child attendance, measured on a continuum between 0 and 1 with 1 being full-time attendance, Y is the family's nonwage assets, w^p is the parents' wage, w^c is the child's wage, and S is a vector of school characteristics which are exogenous to the parents. The opportunity cost of a child's attendance is the value of the child's labor either at home or as an employed worker outside the home.[3] As the value of child labor rises, the incentives to reduce child attendance would increase if income effects of the wage increase are larger than the substitution effects. If child achievement in school is a normal good, increases in parental wages or assets should increase school attendance. The effect of school quality on school attendance is ambiguous.

The production process for human capital produced in the school year, Q, is assumed to depend upon prior accumulations of human capital K_0, a vector of home inputs into the production process H, and the vector of school inputs S. The H and K are assumed to be fixed before the school year begins. The H represents inputs such as the socioeconomic status of the family, parental educational attainment, and the influence of the child's peers or siblings. The child has access to these inputs regardless of whether or not he attends school. However, school inputs are available to the child only if he attends school. This implies that the child's proportion of time spent in school is the proportion of the school characteristics actually used in human capital production. We can express the production of human capital within the period as

$$(2) \qquad Q = g(AS, H, K_0).$$

Multiplying the vector of school characteristics by attendance is done to capture the intensity of investment in schooling. This specification is analogous to the use of utilization rates for capital and labor in studies of industrial production. In the application here, if A equals one, meaning that the child attends full-time, (2) reduces to the "value added" production specification commonly used in the educational production literature. Because daily attendance varied substantially in Maryland in the 1920's and

[3] Here, the child wage in household work is assumed to be equal to the child wage in market work. Since the empirical work is based on a largely rural population, most child labor would be household or farm chores, either in their parents' or their neighbor's home.

1930's, both across time, across county school systems, and across races, the assumption of equal intensity of schooling investment cannot be maintained.

II. Data and Empirical Strategies

First-order approximations of equations (1) and (2) are applied to Maryland data consisting of county averages of school attendance and achievement over the period 1924 through 1938. The data were culled from the *Annual Reports of the Maryland State Board of Education*.[4] The Maryland data are uniquely suited to this study because the State Board of Education kept detailed and consistent statistics on school characteristics for both the 22 black and 23 white county school systems throughout the segregated era. There were no black schools in Garret County. The Baltimore city school system was not under the state system, and is excluded from the sample. The period 1924 through 1938 is used because reading test scores for both the black-and-white schools were available for certain years in that period. Although testing continued in later years, the results of those tests were not preserved.

The empirical analysis is restricted to the primary school data. The main reason is that grade schools represented most if not all of the schooling that children obtained.[5] A second reason is that, because grade schools concentrate more on a core curriculum, a single measure of school output may reasonably characterize the human capital produced in the school. At the secondary level, the curricula become more diverse, and thus it becomes more difficult to adequately portray the school's learning output with one measure of achievement.

Definitions and summary statistics for the variables are presented in Table 1. The dependent variable in the demand equation, *ADA*, is the ratio of average daily attendance to the number of children enrolled in the county grade school system. Black student attendance averaged 7 percentage points below that of white students in the period. The difference in average daily attendance narrowed steadily over the period from 9 percentage points in 1924 to 3 percentage points in 1938, even though white attendance was increasing rapidly.

The dependent variable in the production function is measured as the proportion of students taking a nationally standardized test of reading skills who meet or exceed the national norm for the test. Although the tests differ from year to year, referencing over a common standard of national achievement makes comparison of tested ability feasible. The tests were generally given over the grades 2 through 7, so achievement represents the average achievement in the grade schools as a whole. Tests were given in the white schools in years 1924, 1928, 1932, and 1935. They were administered in the black schools in years 1924, 1932, 1935, and 1938. In total, there are 92 observations for the white schools and 82 for the black schools.[6] Over the period, white test results clearly exceeded black test results, although black students progressed at a more rapid rate. In the two years in which identical tests are available, the ratio of black-to-white student achievement rose from .26 to 1924 to .45 in 1935, even though the proportion of white students meeting national norms had risen from 44 percent in 1924 to 59 percent in 1935. In other words, relative black performance on these exams increased despite improvements in white student performance over the period.

[4] For a detailed description of this data, see my dissertation (1983).

[5] The average attained level of schooling for the cohort entering the labor force in 1930 was 9.6 years for whites and 5.8 years for blacks. The proportion of the population with less than 9 years of schooling was 42 percent for whites and 78 percent for blacks. These figures are for the entire United States. Southern states generally lagged behind the national average in schooling, so the average years of attained schooling for Maryland are probably somewhat lower.

[6] There were two missing observations for black schools in 1924 and 1932. Two black school observations were excluded in 1938 as outliers.

TABLE 1—EMPIRICAL DEFINITIONS AND SUMMARY STATISTICS FOR VARIABLE USED IN ESTIMATING THE SCHOOLING DEMAND AND PRODUCTION EQUATIONS

	Definition	Black Mean	White Mean
Endogenous Variables			
ADA (D)	Average daily attendance in public grade school as a proportion of enrollment	.76	.83
TEST (P)	Proportion of students taking a standardized test of reading skills who meet or exceed the national norm	.225	.54
Exogenous Variables			
EXP1 (D&P)	Proportion of teachers with at least one year of teaching experience	.95	.90
TERM (D&P)	Length of school term	168.9	185.4
CERT (D&P)	Proportion of teachers with at least a normal school certification	.86	.90
SMLSCH (D&P)	Proportion of schools with only one or two teachers	.90	.72
VALUE (D)	Value of school buildings and equipment per enrolled student	.056	.161
(P)	Value of school buildings and equipment per attending student	.07	.193
PTRAT (D)	Number of enrolled students per teacher	37.0	35.5
(P)	Number of attending students per teacher	27.9	29.4
WAGE (D)	Proxy variable for child wage. The measure used is the value of crop production per acre per county per year (1919 dollars)	.24	.24
ASSET (D)	Average value of farm land and buildings per farm per county per year (1919 dollars)	23.56	51.28
SALARY (D)	Index of annual salaries in manufacturing (1919 dollars)	.72	.72
DUM31 (D)	Dummy variable equal to 1 for years preceding 1931		
RACE (P)	Dummy variable equal to 1 for black schools		

Note: (D) signifies a demand variable and (P) signifies a production variable.

The school characteristics include measures of pupils per teacher, school property value, length of term, teacher education and experience, and school consolidation. In the demand function, *PTRAT* is the proportion of students enrolled per teacher. For the production function, *PTRAT* is the proportion of students in average attendance per teacher. The difference arises from the use of a different sample of students in the demand equation than in the production equation. The full sample of enrolled pupils is used in the demand equation, but the intensity of input use in the production equation depends upon the students actually attending class. Similarly, *VALUE* is the assessed valuation of school property and equipment per enrolled student for the attendance equation and per average attendance for the achievement equation. *TERM* is the length of the school term, *CERT* is the proportion of teachers with at least a normal school (two-year teachers college) education, *EXP1* is the proportion of teachers with at least one year of experience,[7] and *SMLSCH* is the proportion of schools with only one or two teachers. The last four variables are measured identically in the two equations.

Child wages are measured by the proxy variable, *WAGE*. The variable *WAGE* captures variations in the value of labor on

[7]Average experience levels for the teachers were not available at the county level for the entire sample period, so the proportion of teachers with some experience was used. This measure has also been utilized by Eric Hanushek (1972) and Richard Murnane (1975).

farms due to yearly fluctuations in agricultural prices or agricultural productivity.[8] In years when agricultural prices are high or crop yields are large, the child wage (the child's value as a laborer in the home) rises as does the opportunity cost of schooling. Adult wages are measured by the variable, *SALARY*, which is an index of yearly manufacturing salaries in Maryland. Child labor laws prevented children from taking manufacturing jobs, so this variable should capture movements in adult wages which are independent of movements of child wages. *ASSET* is a measure of the average value of land and buildings per farm per county per year. These figures were reported separately for nonwhites and whites in Maryland in the *U.S. Census of Agriculture* every five years. For the intervening years, assets were interpolated. *SALARY* and *ASSET* would have pure income effects on attendance, so they should both increase attendance if education is a normal good.[9]

The other variables control for cost variation in schooling across counties and time. A county dummy variable for each was included to capture county-specific, time-invariant costs of schooling. These are attributed to differences in local transportation costs, labor markets, population density, crop mix, and community literacy rates. An additional variable, *DUM31*, is a dummy variable controlling for potential differences in schooling demand preceding a change in the truancy laws in 1931. Its coefficient should be negative because the earlier, less stringent laws would correspond to higher opportunity costs of child time in school.

[8]The use of a measure of the value of child labor in agriculture stems from the rural nature of Maryland population at the time (the United States Census designates 67 percent of the population as rural) and because of the exclusion of Baltimore City from the sample. The correlation between the proxy measure of wages at the state level and an index of agricultural wages was .94.

[9]The use of wage and asset data that aggregate over the entire county population rather than only the population with school children introduces measurement error in the attendance equation. Thus, while the parameter estimates of the attendance equation reported below appear quite reasonable, they should be treated with some caution.

For the production function, the vectors of home inputs common to more recent studies are not available for this study. This lack of data may not be a serious problem here. Commonly used measures of home inputs into child achievement do not vary markedly over time. Thus, measures such as parents' education or occupation are assumed to be fixed over time and captured by county-specific dummy variables. Because of the degree of racial segregation in communities, jobs, churches, and schools during this period, *RACE*, a dummy variable conditioning on the racial designation of the segregated school system, should more adequately control for differences in social or peer influences than the same variable would for current school systems.

Past achievement is also unavailable because tests were not given in concurrent years. However, our measure of achievement, the proportion of the population exceeding the national norm for that grade at the conclusion of the year, helps to mitigate somewhat the potential missing variables problem. Standards for passing from one grade to the next divide the population into categories of previously accumulated human capital, namely those who have attained the level necessary to enter the second grade, the third grade, and so on. This is admittedly a weak control for lagged achievement, so the problem of omitted variables bias may be only partially corrected by the measure of achievement used.

III. Results

This section reports the results obtained from the estimation of the educational demand and educational production equations. The results are used to identify school characteristics that were important in explaining differences in black-and-white attendance and achievement in the period. Finally, the timing of the convergence of these black-and-white school characteristics is discussed.

A. *School Attendance*

The attendance equations are reported in Table 2. The regressions are reported sep-

TABLE 2—ESTIMATES OF GRADE SCHOOL ATTENDANCE EQUATIONS FOR BLACK-AND-WHITE CHILDREN IN MARYLAND, 1924–1938

Variable[a]	White	Black
EXP1	.0484	.0454
	(4.14)	(.918)
TERM/1000	−.4103	.459
	(1.15)	(.887)
VALUE	.023	.0254
	(1.10)	(.227)
PTRAT/100	.1006	−.2135
	(1.95)	(3.06)
CERT	.1253	.0659
	(13.7)	(4.58)
SMLSCH	−.0506	−.340
	(4.38)	(4.96)
WAGE	−.0476	−.1168
	(2.08)	(3.17)
ASSET/100	.0508	.0315
	(5.12)	(2.33)
DUM31	−.0077	−.0409
	(2.76)	(7.73)
SALARY	.0114	.0785
	(.629)	(2.19)
Mean Fixed Effect	.7210[b]	.9495[b]
R^2	.85	.85
N	345	330
Mean of Dependent Variable	.826[c]	.76[c]

[a] *t*-statistics are in parentheses. The dependent variable is the proportion of enrolled students in average daily attendance.

[b] Fixed effects significant at .01 level of confidence.

[c] Using the black mean school characteristics in the white demand function increases predicted white attendance to .836. Using white mean school characteristics in the black demand function increases predicted black attendance to .838.

arately for blacks and whites since the null hypothesis of equal coefficients across the two regressions was rejected at the .01 level of confidence. The model seems to fit the data quite well for both groups, with 85 percent of the variation in average daily attendance explained by the regressors.

The measures of the child's opportunity cost of schooling and the family's income perform quite well in the attendance regressions. In both systems, increasing family assets significantly increases school attendance. In addition, increasing the average manufacturing salary increases school attendance in the black schools. On the other hand, increasing the value of agricultural labor significantly reduces the proportion of the year that black-and-white children attend school. Black attendance is more than twice as sensitive to fluctuations in the local agricultural economy than white attendance. Finally, the relatively less restrictive truancy laws before 1931 are associated with reduced attendance for both black-and-white children.[10]

Although there are no explicit sign predictions on the school quality measures, it is clear that school quality has an effect on schooling demand. Teacher quality in the form of teacher education and experience has a positive effect on attendance in both school systems. Schools organized with one or two teachers have significantly lower attendance for both racial groups. Higher pupil-teacher ratios significantly lower attendance in the black schools but increase attendance in white schools. School value increases attendance in both systems, while length of term raises black attendance but lowers white attendance. Neither of the last two variables has a coefficient that exceeds its standard error in either school system.[11]

The results in Table 2 demonstrate clearly that attendance was sensitive to economic conditions and school quality measures, even though truancy laws were nominally in place throughout the period. As late as 1938, white students were absent an average of 33 days per year and black students were absent an average of 42 days per year. The average absentee rate among white students was so great that black students who attended full-time would have spent more days in school per year (172 days) than the average white student (160 days) despite the large differences in length of term between the black-and-white schools. In other words,

[10] Although the coefficients on the wage proxy, manufacturing salary, and average income had the same signs across the black-and-white attendance equations, the null hypothesis that these responses were equal across two equations was rejected at the .01 level of confidence.

[11] The null hypothesis that black-and-white attendance responsed equally to changes in school quality measures was rejected at the .01 level of confidence.

length of term, in and of itself, did not explain the difference in time spent in school between blacks and whites. Black students attended less than white students because their families were poor, because more young blacks had to work, and because their schools were of lower quality.[12]

To illustrate how much of an effect school characteristics had on the attendance choices of black-and-white children, we can impose white mean school characteristics on the black attendance equation. This empirical equalization of schools results in an increase in mean daily black attendance from 76 percent of enrollment to 84 percent of enrollment. This compares to daily attendance in white schools over the period of 83 percent of enrollment. Raising black school quality to the level found in white schools appears to eliminate the differences in school investment decisions of blacks and whites, even when the controls for home inputs, wages, and family incomes are unchanged.

B. *School Achievement*

The production parameters estimated over the pooled sample of black-and-white students are presented in Table 3.[13] The first column presents the results without imposing the county-specific fixed effects and constraining the black-and-white production parameters to be equal. The second column adds the county-specific fixed effects. The third column adds the fixed effects and allows the production parameters to differ by race. The county-specific fixed effects are used to help control for unmeasured home or school inputs into the human capital production process. The various specifications can explain about 80 percent of the variation in the proportions of students meeting the national norms on tests of reading skills.

The results in column 1 indicate that teacher certification levels, the per pupil value of school property, and the length of school term are the most important school inputs, both in terms of significance levels and in terms of the magnitude of coefficients evaluated at sample means. When the county-specific fixed effects are added, the size and significance of the teacher certification level drops, but length of term and school property value remain important. For both specifications, the dummy variable controlling for the racial designation of the school is negative and significant. The implication is that the levels of unmeasured school and family inputs into the human capital production process are lower for blacks than whites.

In the third column, the production parameters are allowed to differ between the two segregated school systems. For both systems, the hypothesis that school inputs and attendance do not matter in explaining student achievement was rejected at the .01 level of significance.[14] School property value and teacher certification are the most important school inputs for white schools, whereas length of term and school property value are the most important inputs in the black schools. In addition, the measure of teacher experience has a large impact in the black schools when evaluated at the sample mean, but the coefficient is not measured precisely.

The focus of this study is to determine whether the production parameters differ be-

[12] Differences in health might also cause differences in attendance between black-and-white children. However, reported health status is likely to be inaccurate since there is an incentive for parents to declare truant children to be ill. Even so, reported health status is quite similar for black and white children. The Maryland *Annual Reports* listed the proportion of students who withdrew for "mental and physical incapacity" starting in 1929. From 1929 through 1938, .8 percent of the black children and 1 percent of the white children withdrew per year for these health reasons. Over the same period, employment and economic reasons caused 2.7 percent of the black children and 1.3 percent of the white children to withdraw per year. These figures suggest that differences in health status account for little of the difference in attendance between blacks and whites, whereas economic factors are responsible for a large proportion of the difference.

[13] The sample was tested for heteroskedastic errors across races and across time periods. The null hypothesis of homoskedastic errors could not be rejected at the .05 level in either case.

[14] For the white schools, the F-statistic was 5.93. For the black schools, the F-statistic was 5.87. The critical value at the .01 significance level is $F(7,137) = 2.78$.

TABLE 3—ESTIMATES OF THE EDUCATIONAL PRODUCTION EQUATIONS FOR BLACK AND WHITE CHILDREN IN MARYLAND, VARIOUS YEARS BETWEEN 1924–1938

Variable[a]	1 Joint	2 Joint	3 White	3 Black
*EXP*ADA*[b]	.085	−.063	−.107	.463
	(1.05)	(.34)	(.47)	(.71)
*TERM*ADA/100*	.254	.475	.30	.461
	(1.74)	(2.25)	(.59)	(1.83)
*VALUE*ADA*	.432	.654	.581	.822
	(3.71)	(2.69)	(2.09)	(1.57)
*PTRAT*ADA/100*	.164	−.170	.076	.195
	(.49)	(−.41)	(.09)	(.33)
*CERT*ADA*	.255	.093	.325	−.032
	(3.55)	(.90)	(1.50)	(.23)
*SMLSCH*ADA*	−.102	−.057	−.125	.401
	(1.24)	(.42)	(.68)	(1.24)
ADA	−.801	−.058	−.811	−.761
	(2.01)	.10	(.59)	(.94)
RACE	−.25	−.166		−1.06
	(7.89)	(3.61)		(1.46)
CONSTANT	.518	−.20		.544
	(3.01)	(.67)		(.63)
County Fixed Effects	—	included		included
R^2	.79	.80		.81
N	174		174	174
$\hat{Q}_{B/\overline{W}}$	.30	.40		.33
Percent Reduction in Gap	24	57		33
$\hat{Q}_{W/\overline{B}}$	.44	.42		.42
Percent Reduction in Gap	30	38		38

[a] *t*-statistics are in parentheses. The years include 1924, 1928, and 1935 for white children, and 1924, 1932, 1935, and 1938 for black children. The dependent variable is the proportion of students taking a standardized test of reading skill who meet or exceed the national norm for the test.

[b] The predicted value of average daily attendance is used in place of actual value of *ADA* for all school inputs to avoid potential biases caused by correlation between attendance and missing school or home inputs into the human capital production process. The estimated parameters using actual attendance were virtually the same in sign, magnitude, and significance.

tween the black-and-white schools. The null hypothesis that the production coefficients across the black-and-white schools are equal cannot be rejected at the .1 level of significance.[15] Furthermore, the conclusion that the black-and-white human capital production processes are equal appears to be robust to changes in the specification of the production function. For example, inserting the elements of the attendance equation (1) into the production equation (2) yields a quite general quadratic form in school characteristics, economic variables, and fixed effects. The complete system would involve 491 parameters and cannot be estimated. However, a partial specification suppressing the interactions with the county-specific fixed effects involved 152 parameters (22 fixed effects, 128 interaction terms, a constant, and a dummy variable for race). The test of equality of the coefficients across races in

[15] The *F*-statistic on the null hypothesis that the black-and-white coefficients on school characteristics and attendance are equal across races was 0.76, which has a marginal significance level of .62.

this partially unconstrained system also could not be rejected at the .1 level of significance.[16]

To determine the importance of school quality in explaining the differences in human capital between black-and-white children, the results in Table 3 were used to illustrate the impact of artificially equalizing school quality in the black-and-white schools. $\hat{Q}_{B/\bar{W}}$ represents the predicted proportion of black students who would have attained the national norm had black school quality been equal to the mean of the white school characteristics. $\hat{Q}_{W/\bar{B}}$ represents the predicted white student achievement at the mean of black school quality. These predicted values and their corresponding predicted reductions in the gap in black-and-white student achievement are reported at the bottom of Table 3. The results are quite consistent across the various specifications. Improving black schools to the level of average white school quality would have raised average black pass rates from 8 to 18 percentage points. Interestingly, the larger predicted pass rates were found in the specifications controlling for the county fixed effects. Between 24 and 57 percent of the gap in black-and-white achievement would have been eliminated by equalizing school characteristics at the levels found in white schools. Similar conclusions are found with an equalization at black mean school characteristics. White pass rates would have fallen 10 to 12 points with the larger reduction in the fixed effect regressions. Between 30 and 38 percent of the gap in achievement would have been eliminated.[17]

[16] The F-statistic was 1.23, which has a marginal significance level of .3.

[17] These results are similar to the findings of Robert Margo's (1986) study of the effects of school quality on county illiteracy rates in Alabama between 1920 and 1940. Margo found that equalizing school quality would reduce the gap in literacy between blacks and whites aged 7 to 20 by an average of 27 percent, versus an average reduction in the achievement gap of 37 percent reported in Table 3. The somewhat larger effects of equalizing schools in this study are presumably attributable in part to the fact that Margo's literacy measure includes individuals who are not in school and therefore not affected by changes in school quality. His results would thus tend to understate the impact of school equalization on student achievement.

It is interesting to consider the avenue by which achievement is affected. In the black schools, an average of 7 percentage points of the improvement can be attributed directly to the improvement in school quality and another 5 percent to the induced increase in black attendance from the improved school quality. Because white attendance was not changed by reducing white school quality to the level found in the black schools, virtually all of the predicted reduction in white achievement was directly attributable to reductions in school quality.

It is important to emphasize that the finding that the school production parameters were equal across the black-and-white schools only implies that human capital production attributable to school characteristics would have been equalized. Differences in the levels or productivities of household inputs would prevent equality in the overall level of human capital production across races.

C. *The Timing of the Convergence in Black-and-White School Characteristics and Achievement*

By 1935, the last year for which direct comparisons between black-and-white schools can be made, there were two black school systems with over half of their students meeting or exceeding national norms. Four black systems, Allegany (57.8 percent), Wicomico (56.2 percent), Somerset (49.4 percent), and Baltimore county (48.1 percent), had achievement rates that exceeded rates in the worst white school systems. Still, in no county system did black achievement reach the level of white achievement. The best black schools tended to be in counties with the best white schools, and the white schools were consistently of higher quality. Although considerable reductions in the disparity between black-and-white school quality occurred between 1924 and 1938, and although average black achievement relative to white achievement rose from .26 to .45 over the 1924–1935 period, substantial differences between the school systems remained.

The attendance and production function estimates indicated that teacher certification,

teacher experience, length of term, proportion of one and two teacher schools, and value of school property and equipment were important in the human capital production process in the segregated era. By 1938, teacher experience and certification levels had already become equal in Maryland. Length of term was equalized in Maryland grade schools by 1943. Although black schools gained relative to white schools in the value of property per pupil and in the number of one and two teacher schools, these inputs were still unequal by 1955. The value of school property was still 15 percent lower in black schools than white schools, and 15 percent of the black schools still had only one or two teachers compared to 4 percent for the white schools.

Average daily attendance also converged but was not equalized. By 1955, black attendance rates had risen to 92 percent versus 93 percent in the white schools. The results of Tables 2 and 3 indicate that this pattern of convergence in school characteristics across the racial systems in Maryland should correspond to a further convergence in school achievement across the racial systems in the 1940's and 1950's. While it is speculative to relate school achievements to market wages, the timing of the convergence in school characteristics in Maryland is consistent with the convergence in black-and-white returns to schooling reported by Smith and Welch (1986).

IV. Conclusion

This paper analyzed the factors underlying the observed differences in school attendance and achievement between black-and-white grade school children during the segregated era. It was shown that the production process for school achievement and the demand for school attendance were significantly affected by school quality. The results show that, had school quality been equalized at the level in existence in the white schools in the period, both attendance and human capital production in black schools would have increased substantially relative to the levels found in the white schools. These results are consistent with the view that schooling is an important factor in explaining the patterns of human capital accumulation and relative wages for blacks and whites.

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